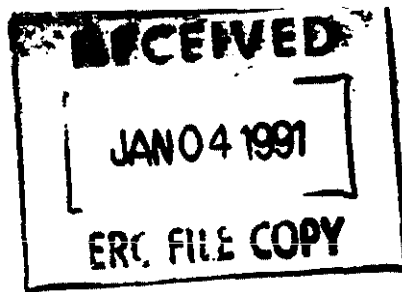


REFERENCE 3



003578

*Quality Assurance Sampling Plan
for*

PCB SOIL SAMPLING IN THE TRANSFORMER YARD (CPP-705)
IDAHO CHEMICAL PROCESSING PLANT

WESTINGHOUSE IDAHO NUCLEAR COMPANY, INC.

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September, 1988

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QUALITY ASSURANCE PROJECT PLAN
PCB SOIL SAMPLING
WESTINGHOUSE IDAHO NUCLEAR COMPANY, INC.
JULY 1988

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APPENDICES:

Appendix #1 CHAIN-OF-CUSTODY FORM

Appendix #2 METHOD OF ANALYSIS

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JULY 1988

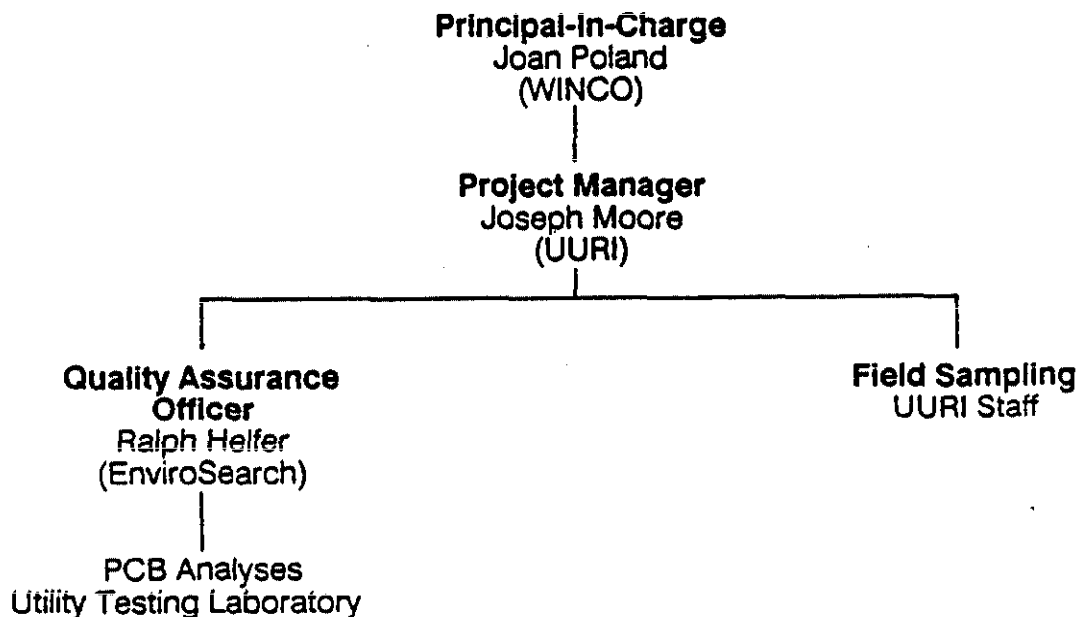
1.0 INTRODUCTION

The sampling and analytical activities to be conducted under this plan are designed to gather the chemical data necessary to determine if soils adjacent to a concrete transformer storage pad in the Transformer Yard (CPP; Figs. 1-3) have been contaminated by polychlorinated biphenyls (PCBs). In addition, substrata soils will be sampled to assess any potential downward migration of PCBs within the site soils. All sampling and analytical methods employed during this project will be those recommended by U.S. Environmental Protection Agency (EPA) protocol in order to produce defensible data of acceptable quality.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Organization

Project organization for the PCB soil sampling project is outlined below:



2.2 Responsibility

2.2.1 Principal-In-Charge

The Principal-In-Charge will have overall responsibility for the project. She or her designated representative will have responsibility for: (1) direction of the project; (2) communication with all principals and agencies involved; and (3) project reports.

2.2.2 Project Manager

The Project Manager will be responsible for: (1) preparation of project sampling plans; (2) execution of all sampling activities in accordance with the project plan; and (3) preparation of a final project report.

2.2.3 Quality Assurance Officer

The project Quality Assurance (QA) Officer will be responsible for: (1) assisting the Project Manager in the preparation of the QA Project Plan; (2) evaluation of sampling procedures; (3) coordination of all laboratory analytical services; (4) evaluation of analytical data; and (5) assisting the Project Manager in preparation of the final project report.

3.0 SAMPLING PROCEDURE

3.1 Sampling Site

The soil area around the concrete transformer storage pad will be divided into four quadrants utilizing the corners of the pad. Judgement sampling will be utilized to collect one composite soil sample from each of two horizons (surface to six inches and eighteen to twenty four inches) in each quadrant for laboratory analysis of PCBs.

3.2 Sampling Techniques

Project soil samples will be collected utilizing decontaminated stainless steel auger and stainless steel hand tools. To ensure the soil samples are

representative, three equal soil aliquots will be collected from each horizon in each quadrant for compositing. The aliquots will be mixed, gently but thoroughly to minimize loss through volatilization, utilizing a decontaminated stainless steel bucket and spoon. Once mixed, the sample will be placed in an appropriate sample container for delivery to the laboratory.

3.3 Sampling Equipment Decontamination

A decontamination area will be set up adjacent to the sampling site for the decontamination of all equipment that may come in contact with potential hazardous constituents. The decontamination area will be approximately six feet by six feet, plastic lined, with its perimeter elevated to contain all contaminated materials on the plastic liner. The decontamination area will be equipped with non-leaking containers, brushes and the solvents required for decontamination.

All sampling equipment used at the site will be decontaminated before, between, and after each sampling use. The decontamination procedure will be scrubbing with detergent and water and utilizing the following rinse sequence: culinary water, dilute hydrochloric acid, distilled water, hexane, and distilled water. After decontamination, the sampling equipment will be allowed to air dry before reuse.

Decontamination liquids will be containerized on-site and handled as PCB waste for final disposition.

3.4 Sample Containers

All samples will be collected in prepared glass containers with Teflon or aluminum-lined screw top lids. The containers will be prepared according to EPA protocol for the analytical method to be employed. Container volume will be adequate at least 60 milliliters.

3.5 Sample Handling

All sample containers will be sealed at the time of collection with a non-tearable seal which bears the sampler's name, sampling date and time, and the sample number. The seal shall be placed over the lid and threads to ensure that the sample container has not been tampered with prior to delivery to the laboratory.

All sample containers shall be labeled at the time of collection with indelible ink pens. Sample labels will contain the following information:

- Site/project code
- Site description
- Date of collection
- Time of collection
- Sample number
- Sample collector(s)
- Requested analysis

After sealing and labeling, sample containers will be placed in an iced cooler, cooled to four degrees Centigrade and kept out of direct sunlight. Coolers will be suitable for transportation and/or shipment to the laboratory.

3.6 Field QA/QC Procedure

3.6.1 Blank Sample

A field blank sample will be prepared, handled along with field samples, and submitted for analysis. Analytical results from the field blank sample will be utilized to assess the quality of field sampling and sample handling procedure in addition to being a quality control check of laboratory analysis.

3.6.2 Duplicate Field Samples

Duplicate field samples will be collected and analyzed at a ratio of approximately one per each set of ten field samples submitted for analysis. The

duplicate samples will be submitted to the laboratory as separate "blind" samples by using fictitious sampling locations on all labels and accompanying documentation. The analytical data from the duplicate field samples will be utilized to assess the quality of field sampling, sample handling, and laboratory analytical procedures.

3.7 Field Log Book

A field log book with bound, consecutively numbered pages, will be maintained by on-site personnel. The information logged on a daily basis, may include but not be limited to:

- Date and time of entry
- Purpose of sampling
- Name and address of field contacts
- Producer of the waste and address
- Type of process producing the waste
- Type of waste
- Description of the sample(s)
- Number and size of samples taken
- Description of sampling point
- Date and time of sample collection
- Collector(s) name and signatures
- References such as maps or photos
- Field observations
- Weather Observations
- Any field measurements such as pH, etc.
- Equipment maintenance performed
- Site safety plan compliance record

4.0 Sample Custody

To establish the documentation necessary to trace sample possession from the time of collection through completion of analysis, the Chain-of-Custody form shown in Appendix 1 will be filled out. This form will accompany the samples to the laboratory and be signed and dated by the laboratory person accepting the samples. All samples will be inspected for damage or tampering before transfer. The Chain-of-Custody form will then be photo copied and the original copy will be returned to the sample collector. The second copy will be retained with the samples until completion of all analyses. It will then be returned with a copy of the analytical results.

5.0 Analytical Procedures

PCB analyses of soil samples will be performed by Utility Testing, Inc. of Salt Lake City, Utah. This laboratory is certified by the Utah Department of Health, State Health Laboratory, Bureau of Laboratory Improvement to perform the required analyses. PCB analysis will be performed utilizing EPA SW-846 Method 8080. The Minimum detection limit (MDL) required for PCB samples during this project is 0.5 mg/Kg. However, the MDL utilizing this analytical methods is estimated to be 0.1 mg/Kg. Since the nature of the sample matrix and potential analytical interferences are unknown, the exact detection limit can not be determined until actual analysis of the samples has been accomplished. The actual MDL will be reported along with the sample results in the final laboratory report.

6.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Laboratory QA/QC procedures will be those outlined in the certified laboratory's Laboratory Quality Assurance Plan on file with the Bureau of Laboratory Improvement, Utah State Health Laboratory. This written laboratory

Quality Assurance Plan conforms with **Rules for the Certification of Environmental Laboratories**, Utah, January 1986. These regulations outline the minimum laboratory quality assurance activities required for laboratory certification.

7.0 DATA REDUCTION, VALIDATION AND REPORTING

7.1 Reduction

To preclude transcription errors, all data reported or reduced to graphs or tables will be crosschecked by a second qualified individual and accompanied with photocopies of the original laboratory report + sheet.

7.2 Validation

Data validation will be accomplished by the internal laboratory QA/QC procedures as outlined in the written Laboratory Quality Assurance Plan on file as described in Section 6.0. In addition, all analytical data will be reviewed by the Project Quality Assurance Officer who will use field and laboratory QA/QC data to assess the quality of analytical results.

7.3 Reporting

After the analytical results for the sampling project have been evaluated, a report on the project status will be submitted to the Project Manager. This report will contain the analytical results, an assessment of data quality and recommendations for corrective actions, if necessary.

8.0 QUALITY CONTROL CHECKS

Field quality control procedures are outlined in Section 3.5. Laboratory quality control checks will include the analysis of blank, duplicate, and standard/standard reference material samples as required by the approved EPA method for analysis and the approved written Laboratory Quality Assurance Plan protocol.

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9.0 PERFORMANCE AND SYSTEM AUDITS

The results of all analyses as well as field and laboratory QC checks will be reviewed by the Project Quality Assurance Officer after completion. A report, as outlined in Section 7.3 will be prepared. Additional sampling may be conducted if deemed necessary by the Principal-In-Charge.

All Utah certified environmental analysis laboratories must participate in the State Health Laboratory and EPA Performance Evaluation Programs. These programs require the laboratory to correctly analyze a series of blind audit samples as a condition of certification.

Annual on-site systems audits are conducted on all certified laboratories by the Utah State Health Laboratory, Bureau of Laboratory Improvement.

10.0 PREVENTIVE MAINTENANCE

All equipment used in conjunction with this project will be maintained in accordance with the manufacturer's recommendations. Necessary maintenance will be accomplished prior to and after each sampling round. All maintenance for field equipment will be recorded in the field log book. The maintenance of laboratory equipment will be documented as required by the individual laboratory's written Laboratory Quality Assurance Plan.

11.0 DATA PRECISION, ACCURACY, AND COMPLETENESS

11.1 Assessment of Data Precision

Data from field and laboratory duplicate samples will be used to assess data precision. The mean and relative standard deviation will be compared with EPA-recommended quality assurance acceptability criteria to ensure data acceptability.

11.2 Assessment of Data Accuracy

Data from the analysis of standards, standard reference materials and spiked samples will be used to determine data accuracy. The mean and relative standard deviation will be compared to EPA-recommended quality assurance acceptability criteria to ensure data acceptability.

11.3 Data Completeness

Completeness will be determined as compared to 100 percent of the data needed to make an accurate assessment of potential PCB contamination in site soils.

12.0 CORRECTIVE ACTIONS

12.1 Laboratory Corrective Actions

Laboratory corrective actions taken to ensure data quality are outlined in the Laboratory Quality Assurance Plan on file with the Bureau of Laboratory Improvement.

12.2 Project Corrective Actions

Corrective actions will be initiated when the project objectives as discussed in Section I are not met or when assessment of data and data quality reveals data of questionable or unknown quality.

Corrective actions may be initiated by any individual on the project, subject to approval by the Principal-In-Charge.

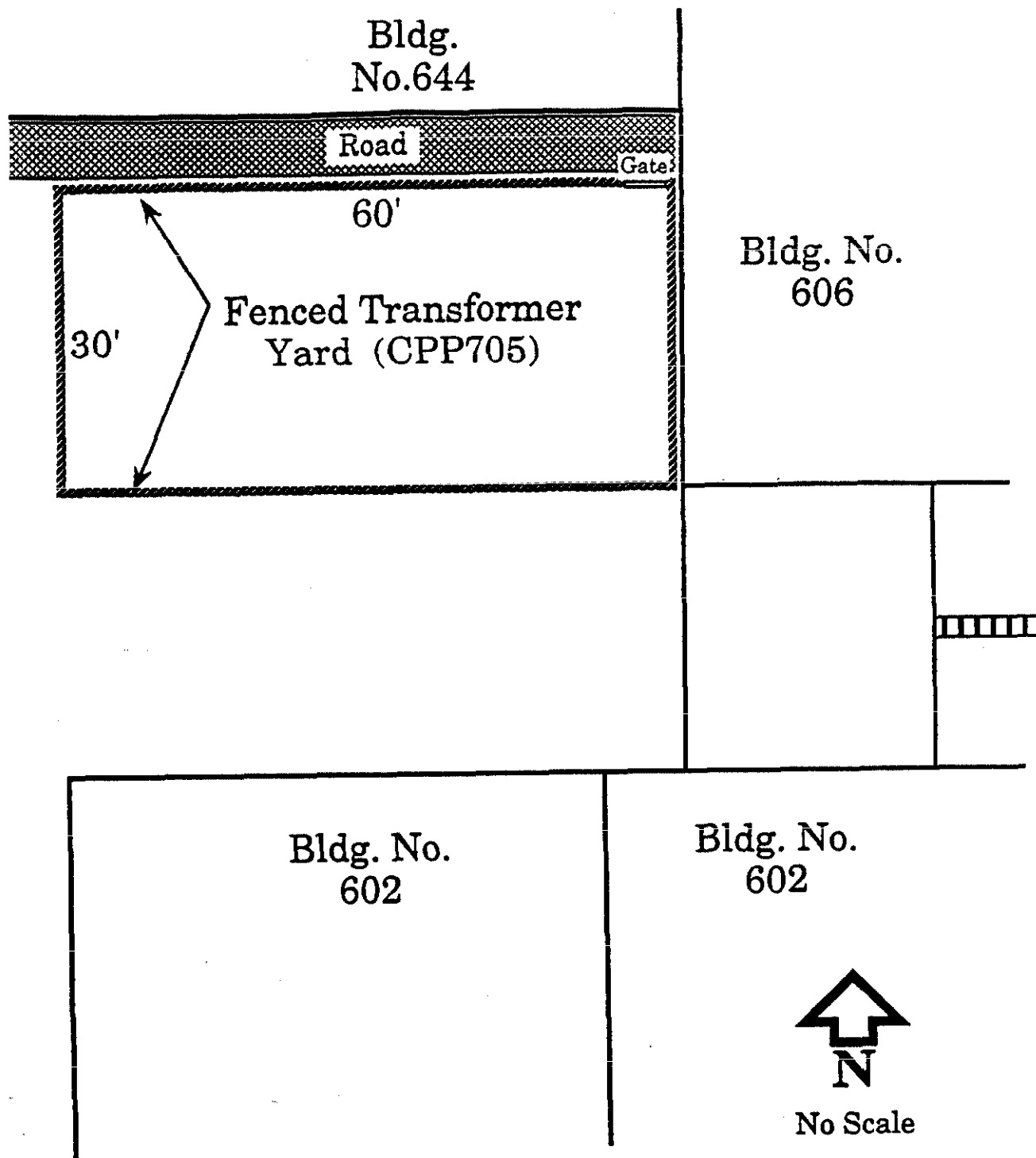
Corrective actions may include but not be limited to: 1) modifications of sampling procedures or additional sampling; 2) modifications of analytical technique within EPA-approved guidelines; and 3) modification of data reporting procedures.

13.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Project Quality Control Officer will prepare a written QA report to management as outlined in Section 7.3. This report will include statements on

data validity, quality and completeness in addition to any recommendations for corrective actions.

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Figure 2. Location of Transformer Yard (CPP-705)

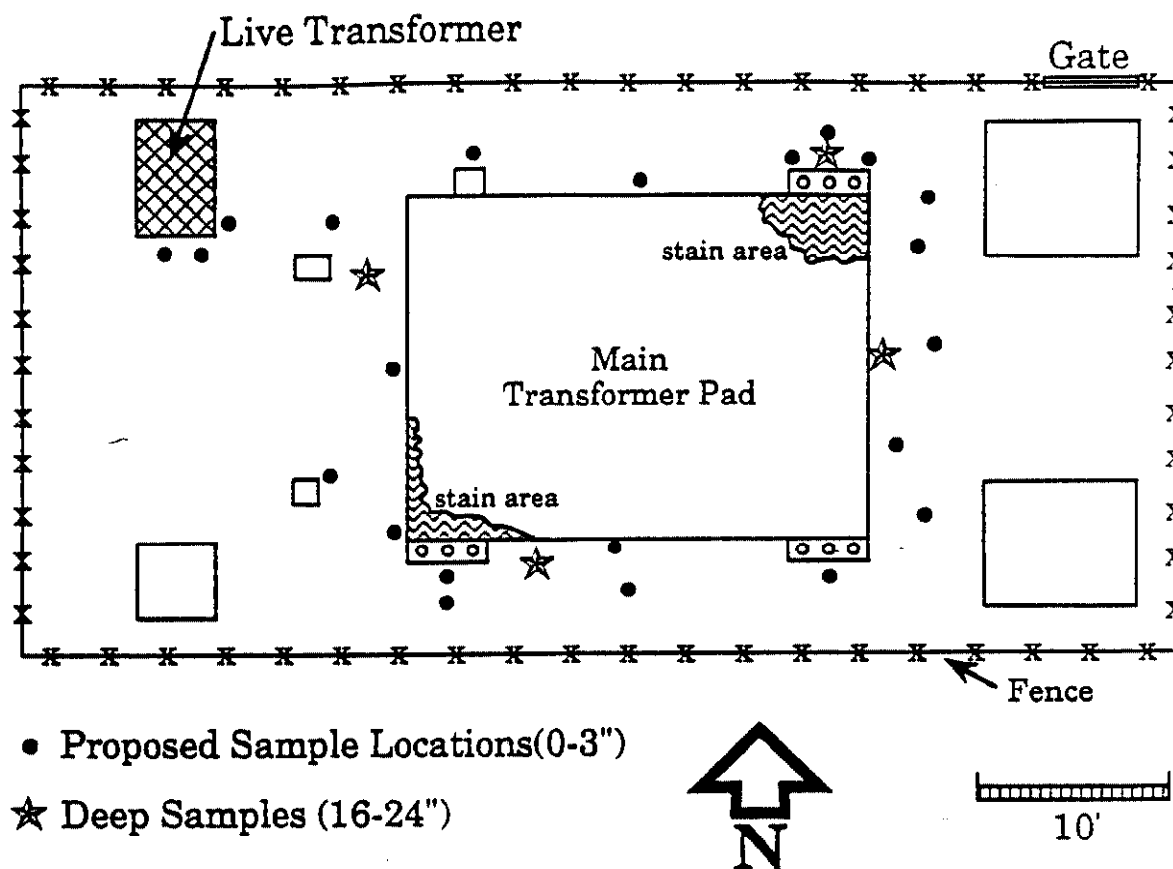


Figure 3. Locations of proposed soil samples in Transformer Yard (CPP-705)

UURI391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108-1295
TELEPHONE 801-524-3422SAMPLE CUSTODY CONTROL RECORD

SAMPLE DATE: _____

WELLS OR MAT'LS SAMPLED: _____

_____SAMPLE NUMBERS _____

_____PARAMETERS FOR ANALYSIS _____

_____SPECIAL INSTRUCTIONS: _____
_____SAMPLE COLLECTION & PRESERVATION

I certify that these samples were collected by me in accordance with EPA procedures and guidelines.

Name Signature Date/TimeRECEIPT ACKNOWLEDGEMENT (LABORATORY)I received the designated samples from _____
at _____ am/pm _____ (date). They were properly sealed __________
Name Signature Date/Time

METHOD 8080

ORGANOCHLORINE PESTICIDES AND PCBs

1.0 SCOPE AND APPLICATION

1.1 Method 8080 is used to determine the concentration of various organochlorine pesticides and polychlorinated biphenyls (PCBs). Table 1 indicates compounds that may be determined by this method and lists the method detection limit for each compound in reagent water. Table 2 lists the practical quantitation limit (PQL) for other matrices.

2.0 SUMMARY OF METHOD

2.1 Method 8080 provides gas chromatographic conditions for the detection of ppb levels of certain organochlorine pesticides and PCBs. Prior to the use of this method, appropriate sample extraction techniques must be used. Both neat and diluted organic liquids (Method 3580, Waste Dilution) may be analyzed by direct injection. A 2- to 5-uL sample is injected into a gas chromatograph (GC) using the solvent flush technique, and compounds in the GC effluent are detected by an electron capture detector (ECD) or a halogen-specific detector (HSD).

2.2 The sensitivity of Method 8080 usually depends on the level of interferences rather than on instrumental limitations. If interferences prevent detection of the analytes, Method 8080 may also be performed on samples that have undergone cleanup. Method 3620, Florisil Column Cleanup, by itself or followed by Method 3660, Sulfur Cleanup, may be used to eliminate interferences in the analysis.

3.0 INTERFERENCES

3.1 Refer to Methods 3500 (Section 3.5, in particular), 3600, and 8000.

3.2 Interferences by phthalate esters can pose a major problem in pesticide determinations when using the electron capture detector. These compounds generally appear in the chromatogram as large late-eluting peaks, especially in the 15% and 50% fractions from the Florisil cleanup. Common flexible plastics contain varying amounts of phthalates. These phthalates are easily extracted or leached from such materials during laboratory operations. Cross contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Interferences from phthalates can best be minimized by avoiding contact with any plastic materials. Exhaustive cleanup of reagents and glassware may be required to eliminate background phthalate contamination. The contamination from phthalate esters can be completely eliminated with a microcoulometric or electrolytic conductivity detector.

TABLE 1. GAS CHROMATOGRAPHY OF PESTICIDES AND PCBs^a

Compound	Retention time (min)		Method Detection limit (ug/L)
	Col. 1	Col. 2	
Aldrin	2.40	4.10	0.004
α -BHC	1.35	1.82	0.003
β -BHC	1.90	1.97	0.006
δ -BHC	2.15	2.20	0.009
γ -BHC (Lindane)	1.70	2.13	0.004
Chlordane (technical)	e	e	0.014
4,4'-DDD	7.83	9.08	0.011
4,4'-DDE	5.13	7.15	0.004
4,4'-DDT	9.40	11.75	0.012
Dieldrin	5.45	7.23	0.002
Endosulfan I	4.50	6.20	0.014
Endosulfan II	8.00	8.28	0.004
Endosulfan sulfate	14.22	10.70	0.066
Endrin	6.55	8.10	0.006
Endrin aldehyde	11.82	9.30	0.023
Heptachlor	2.00	3.35	0.003
Heptachlor epoxide	3.50	5.00	0.083
Methoxychlor	18.20	26.60	0.176
Toxaphene	e	e	0.24
PCB-1016	e	e	nd
PCB-1221	e	e	nd
PCB-1232	e	e	nd
PCB-1242	e	e	0.065
PCB-1248	e	e	nd
PCB-1254	e	e	nd
PCB-1260	e	e	nd

^aU.S. EPA. Method 617. Organochloride Pesticides and PCBs.
Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

e = Multiple peak response.

nd = not determined.

TABLE 2. DETERMINATION OF PRACTICAL QUANTITATION LIMITS (PQL) FOR VARIOUS MATRICES^a

Matrix	Factor ^b
Ground water	10
Low-level soil by sonication with GPC cleanup	670
High-level soil and sludges by sonication	10,000
Non-water miscible waste	100,000

^aSample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

^bPQL = [Method detection limit (Table 1)] X [Factor (Table 2)]. For non-aqueous samples, the factor is on a wet-weight basis.

4.0 APPARATUS AND MATERIALS

4.1 Gas chromatograph:

4.1.1 Gas Chromatograph: Analytical system complete with gas chromatograph suitable for on-column injections and all required accessories, including detectors, column supplies, recorder, gases, and syringes. A data system for measuring peak heights and/or peak areas is recommended.

4.1.2 Columns:

4.1.2.1 Column 1: Supelcoport (100/120 mesh) coated with 1.5% SP-2250/1.95% SP-2401 packed in a 1.8-m x 4-mm I.D. glass column or equivalent.

4.1.2.2 Column 2: Supelcoport (100/120 mesh) coated with 3% OV-1 in a 1.8-m x 4-mm I.D. glass column or equivalent.

4.1.3 Detectors: Electron capture (ECD) or halogen specific (HSD) (i.e., electrolytic conductivity detector).

4.2 Kuderna-Danish (K-D) apparatus:

4.2.1 Concentrator tube: 10-mL, graduated (Kontes K-570050-1025 or equivalent). Ground-glass stopper is used to prevent evaporation of extracts

4.2.2 Evaporation flask: 500-mL (Kontes K-570001-500 or equivalent). Attach to concentrator tube with springs.

4.2.3 Snyder column: Three-ball macro (Kontes K-503000-0121 or equivalent).

4.2.4 Snyder column: Two-ball micro (Kontes K-569001-0219 or equivalent).

4.3 Boiling chips: Solvent extracted, approximately 10/40 mesh (silicon carbide or equivalent).

4.4 Water bath: Heated, with concentric ring cover, capable of temperature control ($\pm 5^{\circ}\text{C}$). The bath should be used in a hood.

4.5 Volumetric flasks: 10-, 50-, and 100-mL, ground-glass stopper.

4.6 Microsyringe: 10-uL.

4.7 Syringe: 5-mL.

4.8 Vials: Glass, 2-, 10-, and 20-mL capacity with Teflon-lined screw cap.

5.0 REAGENTS

5.1 Solvents: Hexane, acetone, toluene, isooctane (2,2,4-trimethylpentane) (pesticide quality or equivalent).

5.2 Stock standard solutions:

5.2.1 Prepare stock standard solutions at a concentration of 1.00 ug/uL by dissolving 0.0100 g of assayed reference material in isooctane and diluting to volume in a 10-mL volumetric flask. A small volume of toluene may be necessary to put some pesticides in solution. Larger volumes can be used at the convenience of the analyst. When compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. Commercially prepared stock standards can be used at any concentration if they are certified by the manufacturer or by an independent source.

5.2.2 Transfer the stock standard solutions into Teflon-sealed screw-cap bottles. Store at 4°C and protect from light. Stock standards should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them.

5.2.3 Stock standard solutions must be replaced after one year, or sooner if comparison with check standards indicates a problem.

5.3 Calibration standards: Calibration standards at a minimum of five concentration levels for each parameter of interest are prepared through dilution of the stock standards with isooctane. One of the concentration levels should be at a concentration near, but above, the method detection limit. The remaining concentration levels should correspond to the expected range of concentrations found in real samples or should define the working range of the GC. Calibration solutions must be replaced after six months, or sooner, if comparison with check standards indicates a problem.

5.4 Internal standards (if internal standard calibration is used): To use this approach, the analyst must select one or more internal standards that are similar in analytical behavior to the compounds of interest. The analyst must further demonstrate that the measurement of the internal standard is not affected by method or matrix interferences. Because of these limitations, no internal standard can be suggested that is applicable to all samples.

5.4.1 Prepare calibration standards at a minimum of five concentration levels for each analyte of interest as described in Paragraph 5.3.

5.4.2 To each calibration standard, add a known constant amount of one or more internal standards, and dilute to volume with isooctane.

5.4.3 Analyze each calibration standard according to Section 7.0.

5.5 Surrogate standards: The analyst should monitor the performance of the extraction, cleanup (when used), and analytical system and the effectiveness of the method in dealing with each sample matrix by spiking each sample, standard, and reagent water blank with pesticide surrogates. Because GC/ECD data are much more subject to interference than GC/MS, a secondary surrogate is to be used when sample interference is apparent. Dibutyl-chlorendate (DBC) is also subject to acid and base degradation. Therefore, two surrogate standards are added to each sample; however, only one need be calculated for recovery. DBC is the primary surrogate and should be used whenever possible. However, if DBC recovery is low or compounds interfere with DBC, then the 2,4,5,6-tetrachloro-meta-xylene should be evaluated for acceptance. Proceed with corrective action when both surrogates are out of limits for a sample (Section 8.3). Method 3500, Section 5.3.2, indicates the proper procedure for preparing these surrogates.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 See the introductory material to this chapter, Organic Analytes, Section 4.1. Extracts must be stored under refrigeration and analyzed within 40 days of extraction.

7.0 PROCEDURE

7.1 Extraction:

7.1.1 Refer to Chapter Two for guidance on choosing the appropriate extraction procedure. In general, water samples are extracted at a neutral, or as is, pH with methylene chloride, using either Method 3510 or 3520. Solid samples are extracted using either Method 3540 or 3550.

7.1.2 Prior to gas chromatographic analysis, the extraction solvent must be exchanged to hexane. The exchange is performed during the K-D procedures listed in all of the extraction methods. The exchange is performed as follows.

7.1.2.1 Following K-D of the methylene chloride extract to 1 mL using the macro-Snyder column, allow the apparatus to cool and drain for at least 10 min.

7.1.2.2 Increase the temperature of the hot water bath to about 90°C. Momentarily remove the Snyder column, add 50 mL of hexane, a new boiling chip, and reattach the macro-Snyder column. Concentrate the extract using 1 mL of hexane to prewet the Snyder column. Place the K-D apparatus on the water bath so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature, as required, to complete concentration in 5-10 min. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood. When the apparent volume of liquid reaches 1 mL, remove the K-D apparatus and allow it to drain and cool for at least 10 min.

7.1.2.3 Remove the Snyder column and rinse the flask and its lower joint into the concentrator tube with 1-2 mL of hexane. A 5-mL syringe is recommended for this operation. Adjust the extract volume to 10.0 mL. Stopper the concentrator tube and store refrigerated at 4°C, if further processing will not be performed immediately. If the extract will be stored longer than two days, it should be transferred to a Teflon-sealed screw-cap vial. Proceed with gas chromatographic analysis if further cleanup is not required.

7.2 Gas chromatography conditions (Recommended):

7.2.1 Column 1: Set 5% methane/95% argon carrier gas flow at 60 mL/min flow rate. Column temperature is set at 200°C isothermal. When analyzing for the low molecular weight PCBs (PCB 1221-PCB 1248), it is advisable to set the oven temperature to 160°C.

7.2.2 Column 2: Set 5% methane/95% argon carrier gas flow at 60 mL/min flow rate. Column temperature held isothermal at 200°C. When analyzing for the low molecular weight PCBs (PCB 1221-PCB 1248), it is advisable to set the oven temperature to 140°C.

7.2.3 When analyzing for most or all of the analytes in this method, adjust the oven temperature and column gas flow so that 4,4'-DDT has a retention time of approximately 12 min.

7.3 Calibration: Refer to Method 8000 for proper calibration techniques. Use Table 1 and especially Table 2 for guidance on selecting the lowest point on the calibration curve.

7.3.1 The procedure for internal or external calibration may be used. Refer to Method 8000 for a description of each of these procedures.

7.3.2 Because of the low concentration of pesticide standards injected on a GC/ECD, column adsorption may be a problem when the GC has not been used for a day. Therefore, the GC column should be primed or deactivated by injecting a PCB or pesticide standard mixture approximately 20 times more concentrated than the mid-level standard. Inject this prior to beginning initial or daily calibration.

7.4 Gas chromatographic analysis:

7.4.1 Refer to Method 8000. If the internal standard calibration technique is used, add 10 uL of internal standard to the sample prior to injection.

7.4.2 Follow Section 7.6 in Method 8000 for instructions on the analysis sequence, appropriate dilutions, establishing daily retention time windows, and identification criteria. Include a mid-level standard after each group of 10 samples in the analysis sequence.

7.4.3 Examples of GC/ECD chromatograms for various pesticides and PCBs are shown in Figures 1 through 5.

7.4.4 Prime the column as per Paragraph 7.3.2.

7.4.5 DDT and endrin are easily degraded in the injection port if the injection port or front of the column is dirty. This is the result of buildup of high boiling residue from sample injection. Check for degradation problems by injecting a mid-level standard containing only 4,4'-DDT and endrin. Look for the degradation products of 4,4'-DDT (4,4'-DDE and 4,4'-DDD) and endrin (endrin ketone and endrin aldehyde). If degradation of either DDT or endrin exceeds 20%, take corrective action before proceeding with calibration, by following the GC system maintenance outlined in Section 7.7 of Method 8000. Calculate percent breakdown as follows:

$$\begin{array}{l} \text{\% breakdown} \\ \text{for 4,4'-DDT} \end{array} = \frac{\text{Total DDT degradation peak area (DDE + DDD)}}{\text{Total DDT peak area (DDT + DDE + DDD)}} \times 100$$

$\begin{array}{l} \text{\% breakdown} \\ \text{for Endrin} \end{array} =$

$$\frac{\text{Total endrin degradation peak area (endrin aldehyde + endrin ketone)}}{\text{Total endrin peak area (endrin + endrin aldehyde + endrin ketone)}} \times 100$$

7.4.6 Record the sample volume injected and the resulting peak sizes (in area units or peak heights).

7.4.7 Using either the internal or external calibration procedure (Method 8000), determine the identity and quantity of each component peak in the sample chromatogram which corresponds to the compounds used for calibration purposes.

7.4.8 If peak detection and identification are prevented due to interferences, the hexane extract may need to undergo cleanup using Method 3620. The resultant extract(s) may be analyzed by GC directly or may undergo further cleanup to remove Sulfur using Method 3660.

7.5 Cleanup:

7.5.1 Proceed with Method 3620, followed by, if necessary, Method 3660, using the 10-mL hexane extracts obtained from Paragraph 7.1.2.3.

7.5.2 Following cleanup, the extracts should be analyzed by GC, as described in the previous paragraphs and in Method 8000.

7.6 Calculations (exerpted from U.S. FDA, PAM):

7.6.1 Calculation of Certain Residues: Residues which are mixtures of two or more components present problems in measurement. When they are found together, e.g., toxaphene and DDT, the problem of quantitation becomes even more difficult. In the following sections suggestions are offered for handling toxaphene, chlordane, PCB, DDT, and BHC. A column 10% DC-200 stationary phase was used to obtain the chromatograms in Figures 6-9.

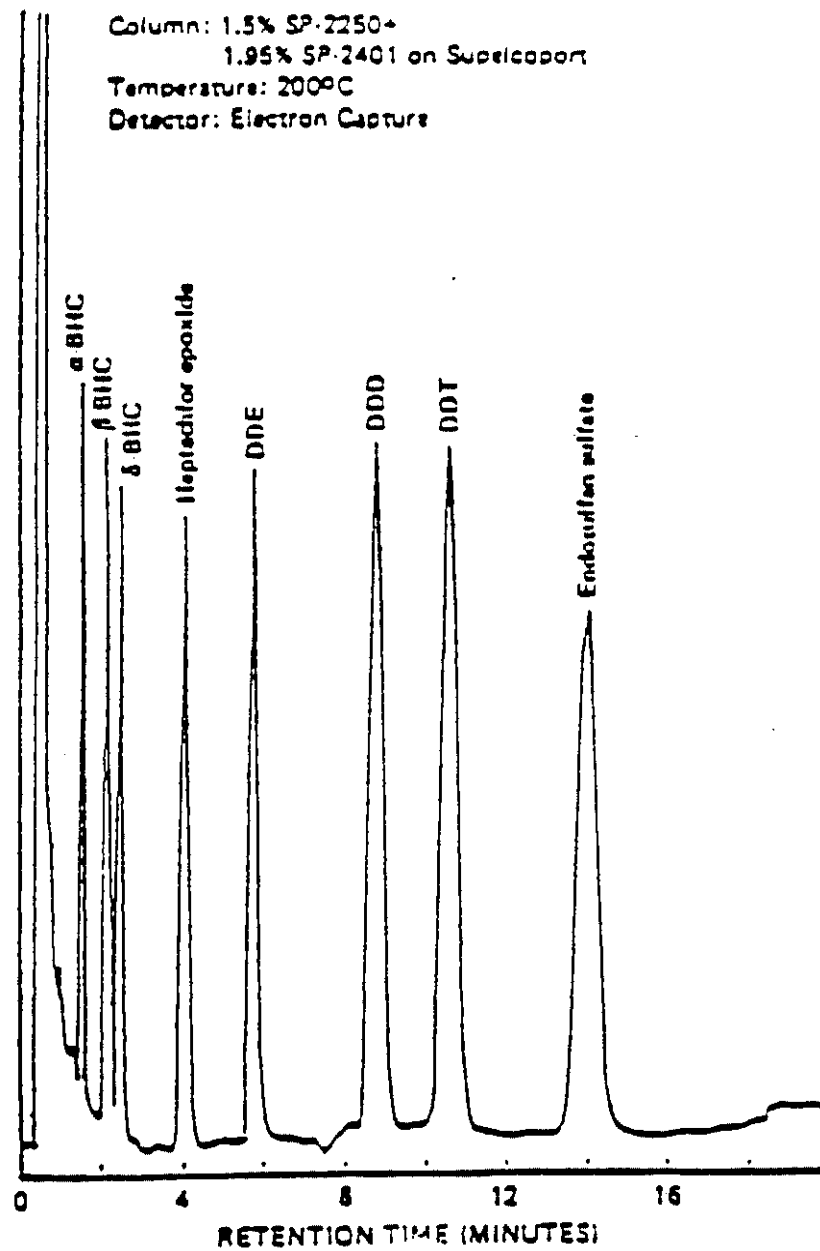


Figure 1. Gas chromatogram of pesticides.

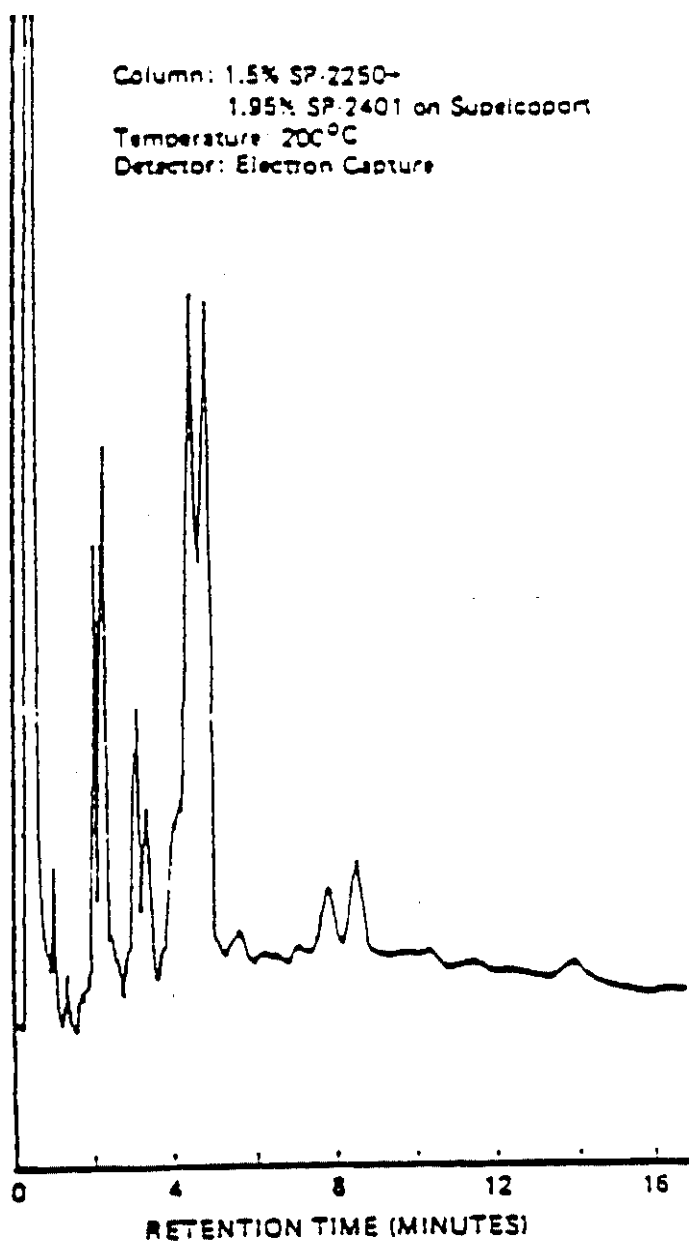


Figure 2. Gas chromatogram of chlordane.

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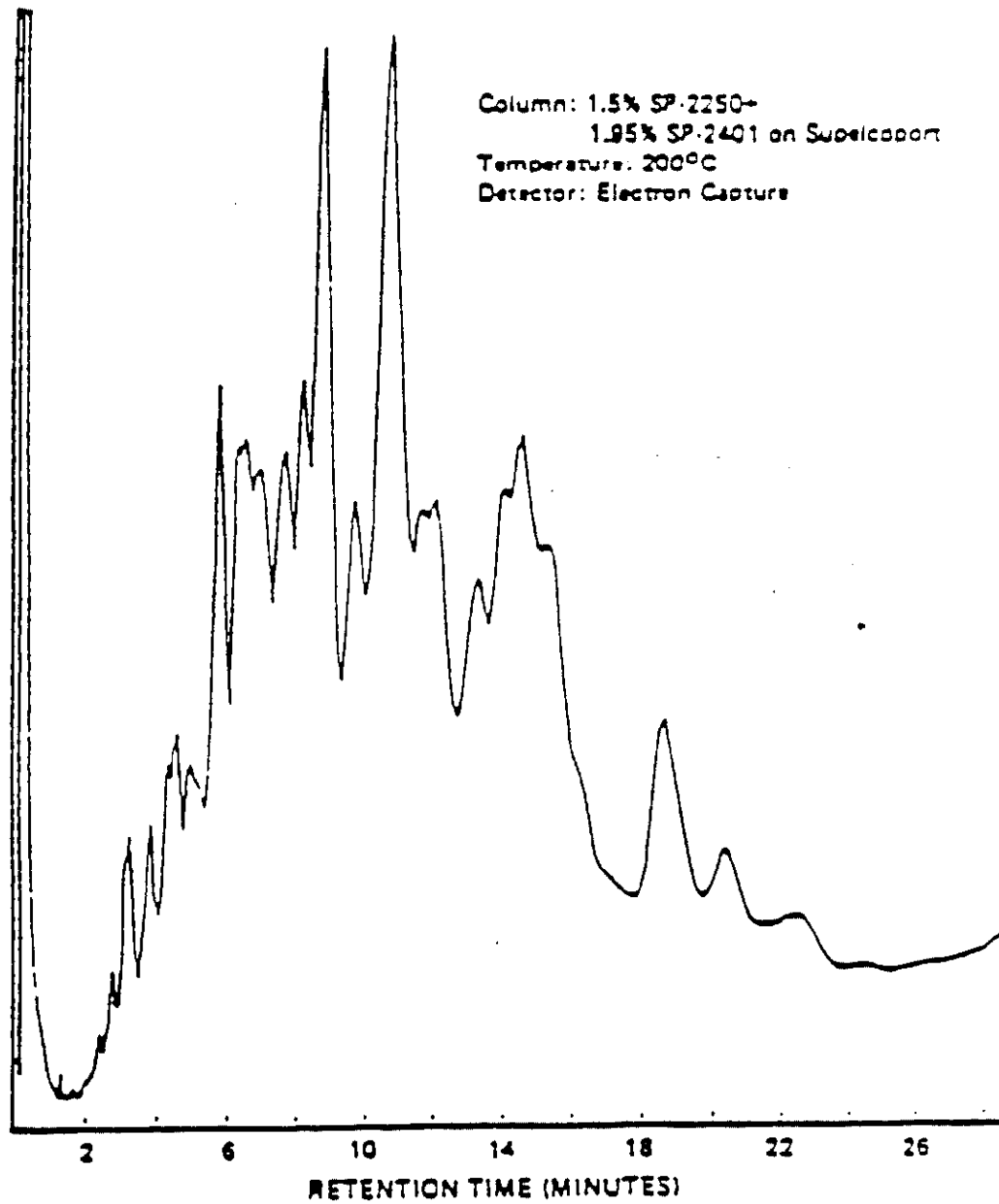


Figure 3. Gas chromatogram of toxaphene.

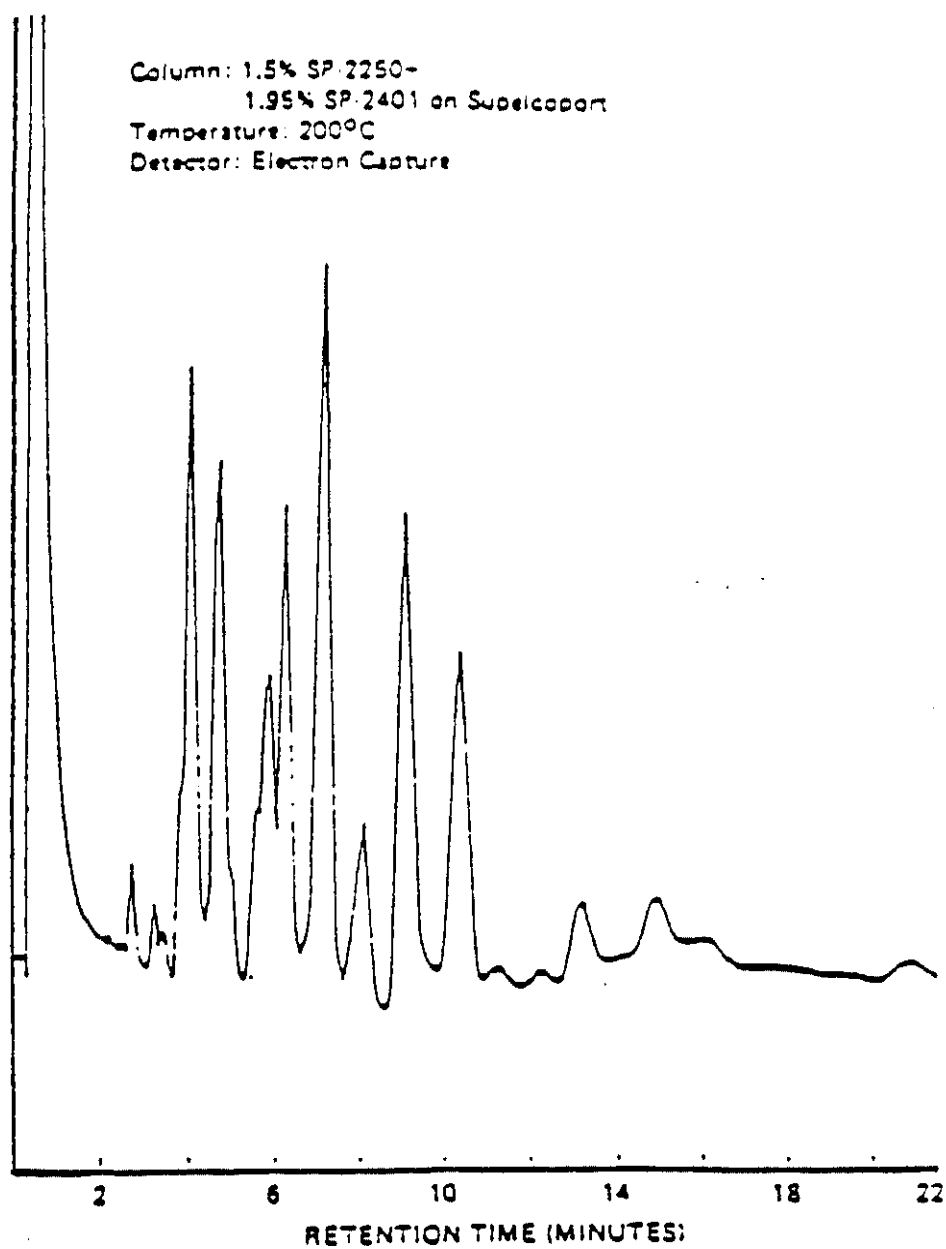


Figure 4. Gas chromatogram of PCB-1254.

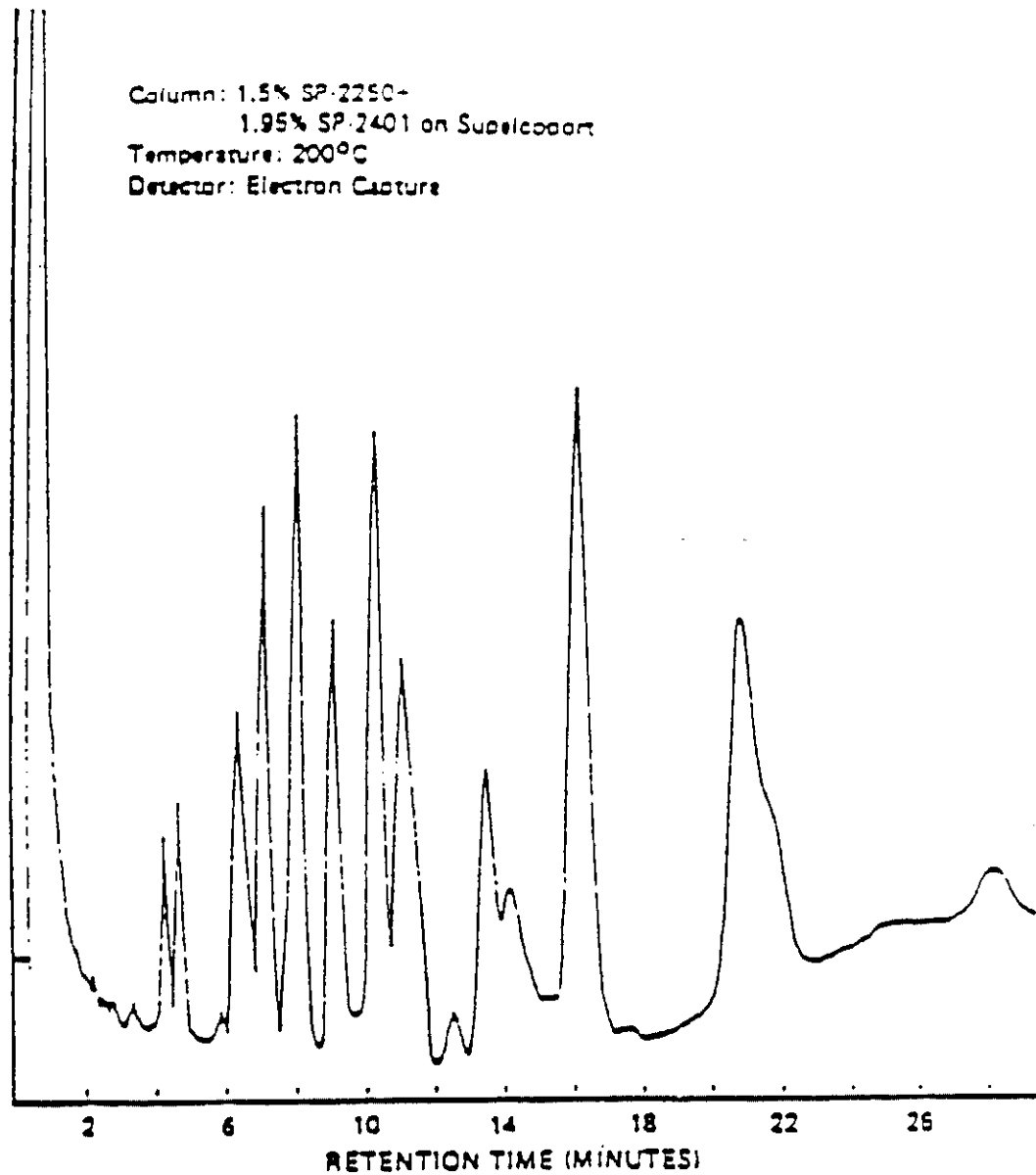


Figure 5. Gas chromatogram of PCB-1260.

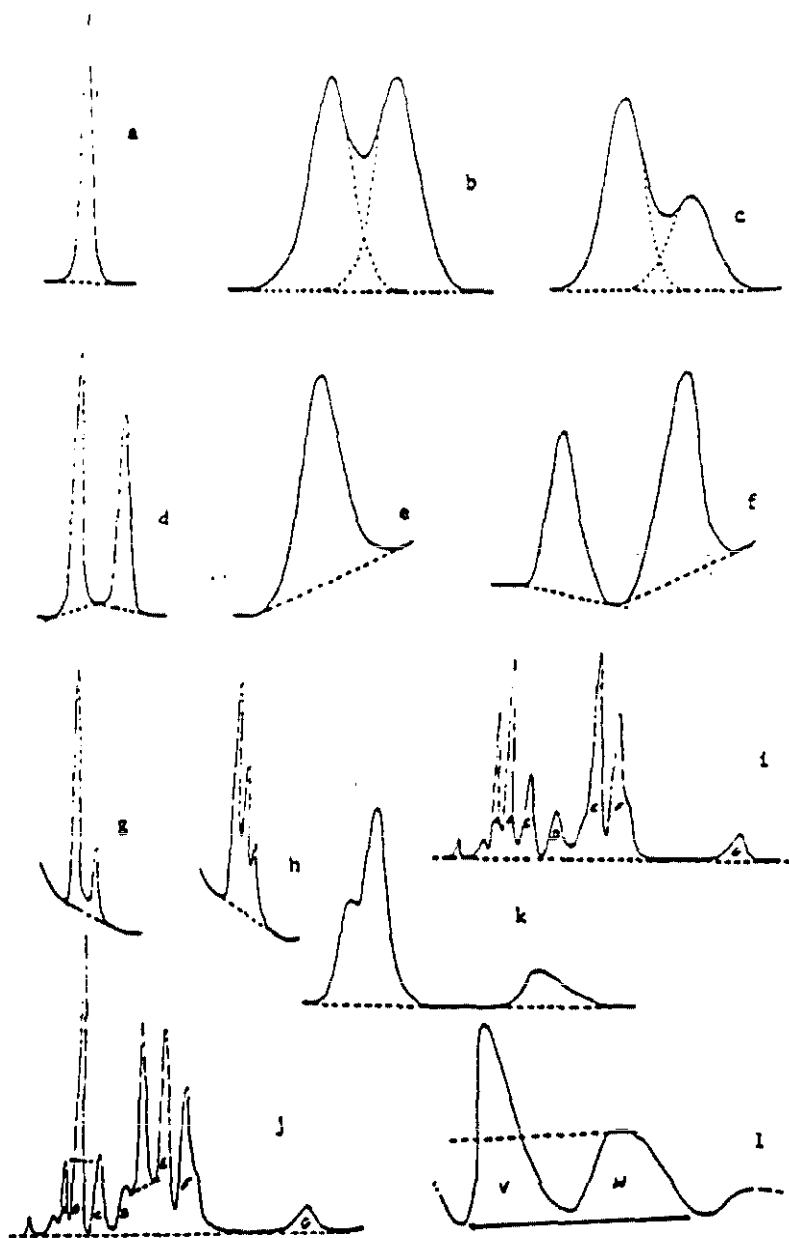


Fig. 6—Baseline construction for some typical gas chromatographic peaks. a, symmetrical separated (flat baseline); b and c, overlapping (flat baseline); d, separated (pen does not return to baseline between peaks); e, separated sloping baseline; f, separated (pen goes below baseline between peaks); g, α - and γ -BHC sloping baseline; h, α -, β -, and γ -BHC sloping baseline; i, chlordane (flat baseline); j, heptachlor and heptachlor epoxide superimposed on chlordane; k, chair-shaped peaks, unsymmetrical peak; l, p,p'-DDT superimposed on toxaphene.

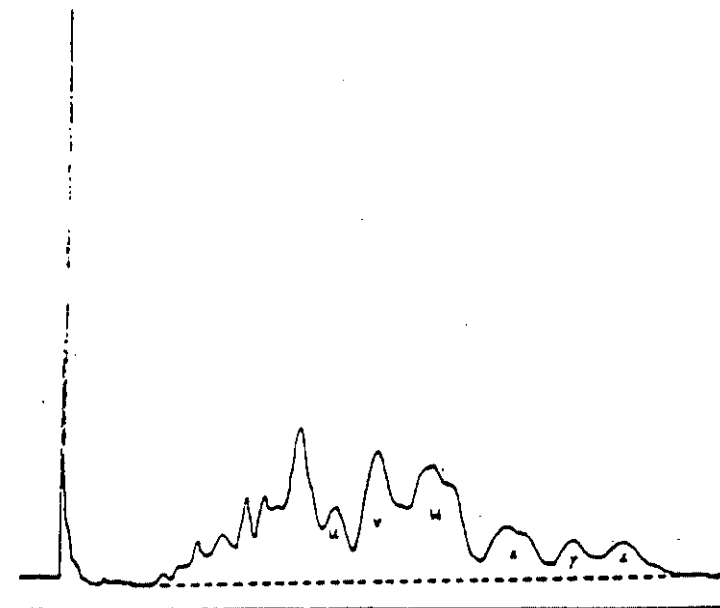


Fig. 7a--Baseline construction for multiple residues with standard toxaphene.

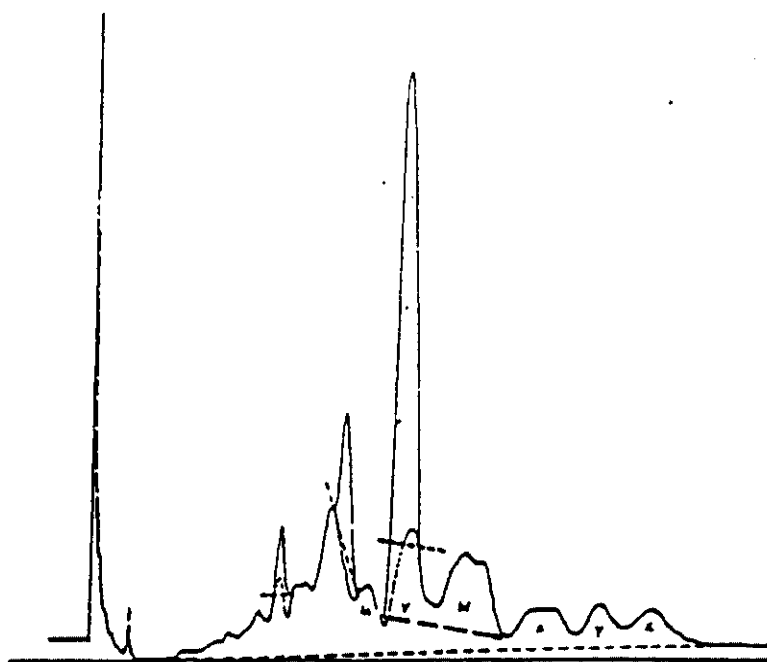


Fig. 7b--Baseline construction for multiple residues with toxaphene, DOE and o,p'-, and p,p'-DDT.

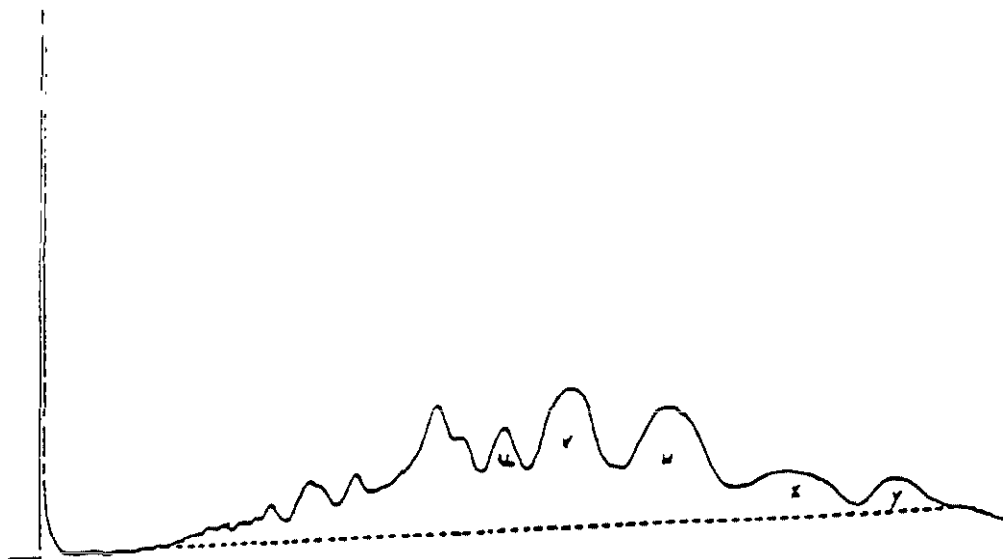


Fig. 8a--Baseline construction for multiple residues: standard toxaphene.

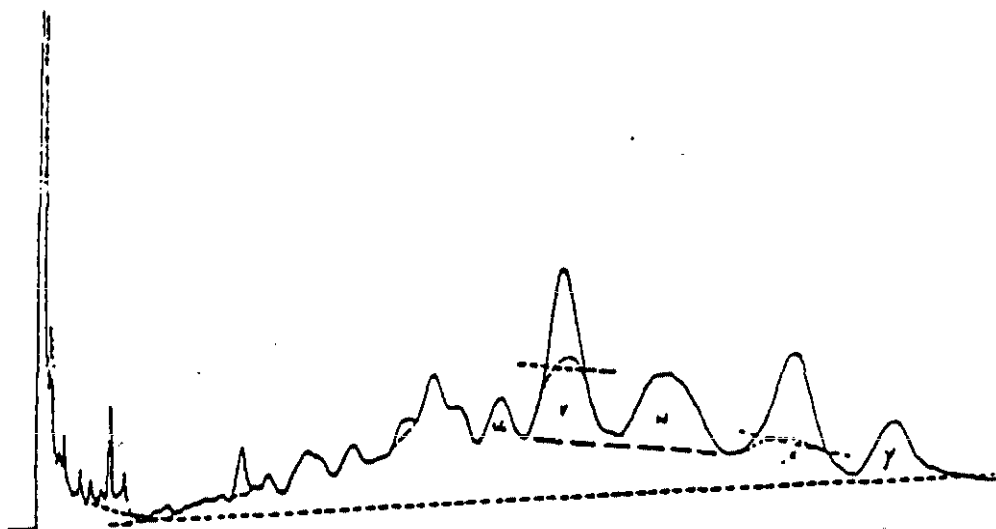


Fig. 8b--Baseline construction for multiple residues: rice bran with BHC, toxaphene, DDT, and methoxychlor.

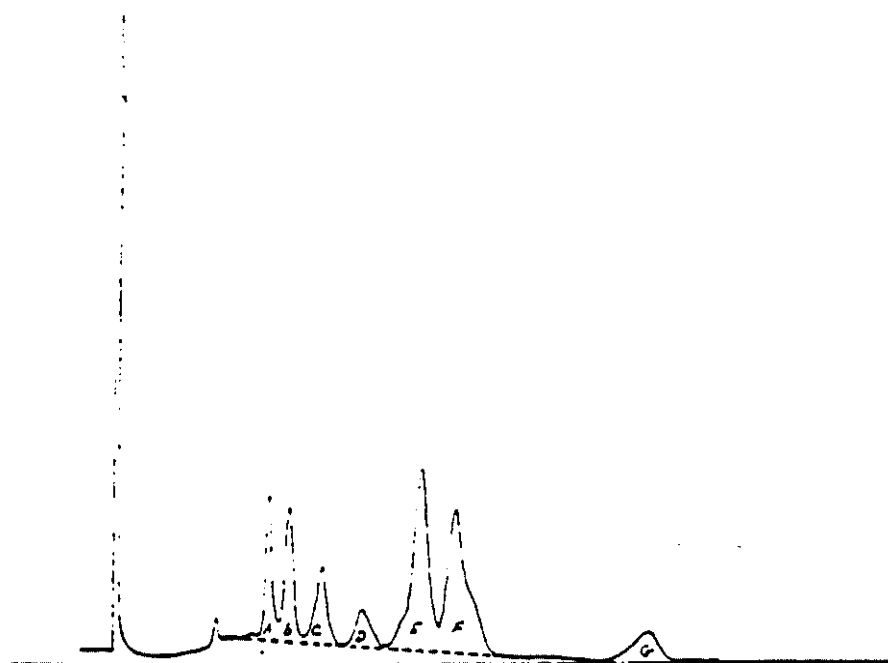


Fig. 9a—Baseline construction for multiple residues: standard chlordane.

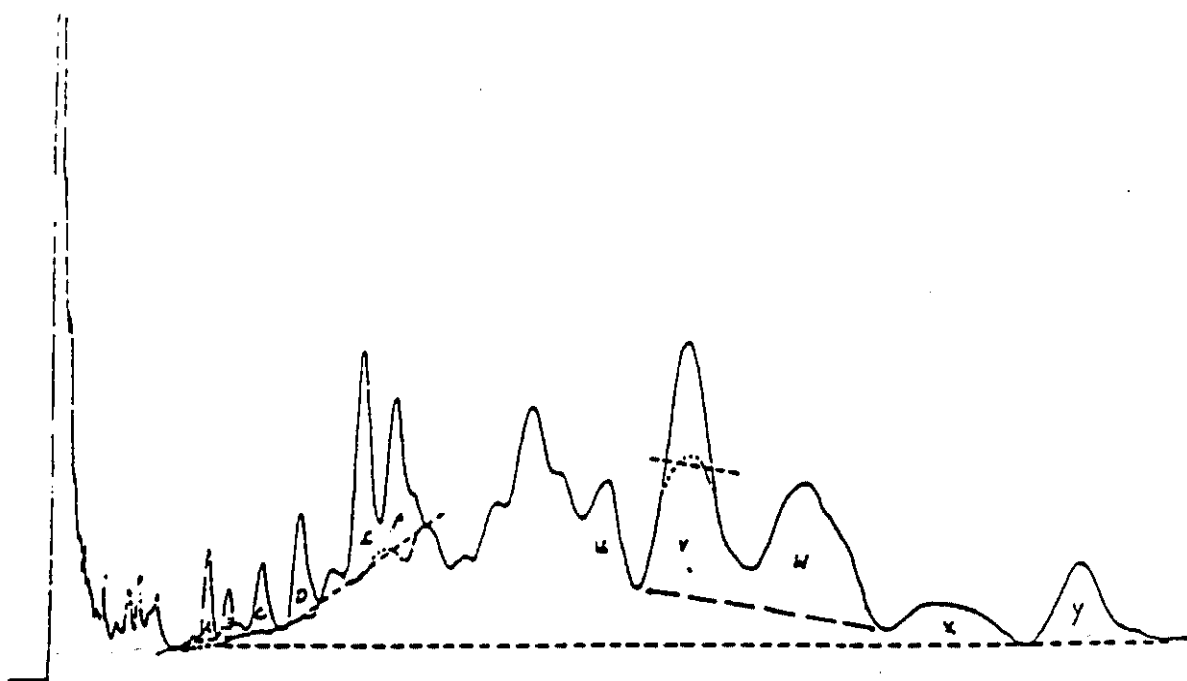


Fig. 9b—Baseline construction for multiple residues: rice bran with chlordane, toxaphene, and DDT.

7.6.2 Toxaphene: Quantitative calculation of toxaphene or Strobane is difficult, but reasonable accuracy can be obtained. To calculate toxaphene on GC/ECD: (a) adjust sample size so that toxaphene major peaks are 10-30% full-scale deflection (FSD); (b) inject a toxaphene standard that is estimated to be within ± 10 ng of the sample; (c) construct the baseline of standard toxaphene between its extremities; and (d) construct the baseline under the sample, using the distances of the peak troughs to baseline on the standard as a guide (Figures 7, 8, and 9). This procedure is made difficult by the fact that the relative heights and widths of the peaks in the sample will probably not be identical to the standard. A toxaphene standard that has been passed through a Florisil column will show a shorter retention time for peak X and an enlargement of peak Y.

7.6.3 Toxaphene and DDT: If DDT is present, it will superimpose itself on toxaphene peak V. To determine the approximate baseline of the DDT, draw a line connecting the trough of peaks U and V with the trough of peaks W and X and construct another line parallel to this line which will just cut the top of peak W (Figure 61). This procedure was tested with ratios of standard toxaphene-DDT mixtures from 1:10 to 2:1 and the results of added and calculated DDT and toxaphene by the "parallel lines" method of baseline construction were within 10% of the actual values in all cases.

7.6.3.1 A series of toxaphene residues have been calculated using total peak area for comparison to the standard and also using area of the last four peaks only in both sample and standard. The agreement between the results obtained by the two methods justifies the use of the latter method for calculating toxaphene in a sample where the early eluting portion of the toxaphene chromatogram is interfered with by other substances.

7.6.3.2 The baseline for methoxychlor superimposed on toxaphene (Figure 8b) was constructed by overlaying the samples on a toxaphene standard of approximately the same concentration (Figure 8a) and viewing the charts against a lighted background.

7.6.4 Chlordane is a technical mixture of at least 11 major components and 30 or more minor ones. Gas chromatography-mass spectrometry and nuclear magnetic resonance analytical techniques have been applied to the elucidation of the chemical structures of the many chlordane constituents. Figure 9a is a chromatogram of standard chlordane. Peaks E and F are responses to trans- and cis-chlordane, respectively. These are the two major components of technical chlordane, but the exact percentage of each in the technical material is not completely defined and is not consistent from batch to batch. Other labelled peaks in Figure 9a are thought to represent: A, monochlorinated adduct of pentachlorocyclopentadiene with cyclopentadiene; B, coelution of heptachlor and α -chlordene; C, coelution of β -chlordene and γ -chlordene;

D, a chlordane analog; G, coelution of cis-nonachlor and "Compound K," a chlordane isomer. The right "shoulder" of peak F is caused by trans-nonachlor.

7.6.4.1 The GC pattern of a chlordane residue may differ considerably from that of the technical standard. Depending on the sample substrate and its history, residues of chlordane can consist of almost any combination of: constituents from the technical chlordane; plant and/or animal metabolites; and products of degradation caused by exposure to environmental factors such as water and sunlight. Only limited information is available on which residue GC patterns are likely to occur in which samples types, and even this information may not be applicable to a situation where the route of exposure is unusual. For example, fish exposed to a recent spill of technical chlordane will contain a residue drastically different from a fish whose chlordane residue was accumulated by ingestion of smaller fish or of vegetation, which in turn had accumulated residues because chlordane was in the water from agricultural runoff.

7.6.4.2 Because of this inability to predict a chlordane residue GC pattern, it is not possible to prescribe a single method for the quantitation of chlordane residues. The analyst must judge whether or not the residue's GC pattern is sufficiently similar to that of a technical chlordane reference material to use the latter as a reference standard for quantitation.

7.6.4.3 When the chlordane residue does not resemble technical chlordane, but instead consists primarily of individual, identifiable peaks, quantitate each peak separately against the appropriate reference materials and report the individual residues. (Reference materials are available for at least 11 chlordane constituents, metabolites or degradation products which may occur in the residue.)

7.6.4.4 When the GC pattern of the residue resembles that of technical chlordane, quantitate chlordane residues by comparing the total area of the chlordane chromatogram from peaks A through F (Figure 9a) in the sample versus the same part of the standard chromatogram. Peak G may be obscured in a sample by the presence of other pesticides. If G is not obscured, include it in the measurement for both standard and sample. If the heptachlor epoxide peak is relatively small, include it as part of the total chlordane area for calculation of the residue. If heptachlor and/or heptachlor epoxide are much out of proportion as in Figure 6j, calculate these separately and subtract their areas from total area to give a corrected chlordane area. (Note that octachlor epoxide, metabolite of chlordane, can easily be mistaken for heptachlor epoxide on a nonpolar GC column.)

7.6.4.5 To measure the total area of the chlordane chromatogram, proceed as in Section 7.6.2 on toxaphene. Inject an amount of technical chlordane standard which will produce a chromatogram in which peaks E and F are approximately the same size as those in the sample chromatograms. Construct the baseline beneath the standard from the beginning of peak A to the end of peak F as shown in Figure 9a. Use the distance from the trough between peaks E and F to the baseline in the chromatogram of the standard to construct the baseline in the chromatogram of the sample. Figure 9b shows how the presence of toxaphene causes the baseline under chlordane to take an upward angle. When the size of peaks E and F in standard and sample chromatograms are the same, the distance from the trough of the peaks to the baselines should be the same. Measurement of chlordane area should be done by total peak area if possible.

NOTE: A comparison has been made of the total peak area integration method and the addition of peak heights method for several samples containing chlordane. The peak heights A, B, C, D, E, and F were measured in millimeters from peak maximum of each to the baseline constructed under the total chlordane area and were then added together. These results obtained by the two techniques are too close to ignore this method of "peak height addition" as a means of calculating chlordane. The technique has inherent difficulties because not all the peaks are symmetrical and not all are present in the same ratio in standard and in sample. This method does offer a means of calculating results if no means of measuring total area is practical.

7.6.5 Polychlorinated biphenyls (PCBs): Quantitation of residues of PCB involves problems similar to those encountered in the quantitation of toxaphene, Strobane, and chlordane: in each case, the chemical is made up of numerous compounds and so the chromatograms are multi-peak; also in each case the chromatogram of the residue may not match that of the standard.

7.6.5.1 Mixtures of PCB of various chlorine contents were sold for many years in the U.S. by the Monsanto Co. under the tradename Aroclor (1200 series and 1016). Though these Aroclors are no longer marketed, the PCBs remain in the environment and are sometime found as residues in foods, especially fish.

7.6.5.2 PCB residues are quantitated by comparison to one or more of the Aroclor materials, depending on the chromatographic pattern of the residue. A choice must be made as to which Aroclor or mixture of Aroclors will produce a chromatogram most similar to that of the residue. This may also involve a judgment about what proportion of the different Aroclors to combine to produce the appropriate reference material.

7.6.5.3 Quantitate PCB residues by comparing total area or height of residue peaks to total area or height of peaks from appropriate Aroclor(s) reference materials. Measure total area or height response from common baseline under all peaks. Use only those peaks from sample that can be attributed to chlorobiphenyls. These peaks must also be present in chromatogram of reference materials. Mixture of Aroclors may be required to provide best match of GC patterns of sample and reference.

7.6.6 DDT: DDT found in samples often consists of both o,p'- and p,p'-DDT. Residues of DDE and TDE are also frequently present. Each isomer of DDT and its metabolites should be quantitated using the pure standard of that compound and reported as such.

7.6.7 Hexachlorocyclohexane (BHC, from the former name, benzene hexachloride): Technical grade BHC is a cream-colored amorphous solid with a very characteristic musty odor; it consists of a mixture of six chemically distinct isomers and one or more heptachloro-cyclohexanes and octachloro-cyclohexanes.

7.6.7.1 Commercial BHC preparations may show a wide variance in the percentage of individual isomers present. The elimination rate of the isomers fed to rats was 3 weeks for the α -, γ -, and δ -isomers and 14 weeks for the β -isomer. Thus it may be possible to have any combination of the various isomers in different food commodities. BHC found in dairy products usually has a large percentage of β -isomer.

7.6.7.2 Individual isomers (α , β , γ , and δ) were injected into gas chromatographs equipped with flame ionization, microcoulometric, and electron capture detectors. Response for the four isomers is very nearly the same whether flame ionization or microcoulometric GLC is used. The α -, γ -, and δ -isomers show equal electron affinity. β -BHC shows a much weaker electron affinity compared to the others isomers.

7.6.7.3 Quantitate each isomer (α , β , γ , and δ) separately against a standard of the respective pure isomer, using a GC column which separates all the isomers from one another.

8.0 QUALITY CONTROL

8.1 Refer to Chapter One for specific quality control procedures. Quality control to validate sample extraction is covered in Method 3500 and in the extraction method utilized. If extract cleanup was performed, follow the QC in Method 3600 and in the specific cleanup method.

8.2 Mandatory quality control to evaluate the GC system operation is found in Method 8000, Section 8.6.

8.2.1 The quality control check sample concentrate (Method 8000, Section 8.6) should contain each single-component parameter of interest at the following concentrations in acetone: 4,4'-DDD, 10 ug/mL; 4,4'-DDT, 10 ug/mL; endosulfan II, 10 ug/mL; endosulfan sulfate, 10 ug/mL; endrin, 10ug/mL; and any other single-component pesticide, 2 ug/mL. If this method is only to be used to analyze for PCBs, chlordane, or toxaphene, the QC check sample concentrate should contain the most representative multi-component parameter at a concentration of 50 ug/mL in acetone.

8.2.2 Table 3 indicates the calibration and QC acceptance criteria for this method. Table 4 gives method accuracy and precision as functions of concentration for the analytes of interest. The contents of both Tables should be used to evaluate a laboratory's ability to perform and generate acceptable data by this method.

8.3 Calculate surrogate standard recovery on all samples, blanks, and spikes. Determine if the recovery is within limits (limits established by performing QC procedures outlined in Method 8000, Section 8.10).

8.3.1 If recovery is not within limits, the following is required.

- Check to be sure there are no errors in calculations, surrogate solutions and internal standards. Also, check instrument performance.
- Recalculate the data and/or reanalyze the extract if any of the above checks reveal a problem.
- Reextract and reanalyze the sample if none of the above are a problem or flag the data as "estimated concentration."

8.4 GC/MS confirmation: Any compounds confirmed by two columns may also be confirmed by GC/MS if the concentration is sufficient for detection by GC/MS as determined by the laboratory generated detection limits.

8.4.1 The GC/MS would normally require a minimum concentration of 10 ng/uL in the final extract, for each single-component compound.

8.4.2 The pesticide extract and associated blank should be analyzed by GC/MS as per Section 7.0 of Method 8270.

8.4.3 The confirmation may be from the GC/MS analysis of the base/neutral-acid extractables extracts (sample and blank). However, if the compounds are not detected in the base/neutral-acid extract even though the concentration is high enough, a GC/MS analysis of the pesticide extract should be performed.

8.4.4 A reference standard of the compound must also be analyzed by GC/MS. The concentration of the reference standard must be at a level that would demonstrate the ability to confirm the pesticides/PCBs identified by GC/ECD.

9.0 METHOD PERFORMANCE

9.1 The method was tested by 20 laboratories using reagent water, drinking water, surface water, and three industrial wastewaters spiked at six concentrations. Concentrations used in the study ranged from 0.5 to 30 ug/L for single-component pesticides and from 8.5 to 400 ug/L for multi-component parameters. Single operator precision, overall precision, and method accuracy were found to be directly related to the concentration of the parameter and essentially independent of the sample matrix. Linear equations to describe these relationships for a flame ionization detector are presented in Table 4.

9.2 The accuracy and precision obtained will be determined by the sample matrix, sample-preparation technique, optional cleanup techniques, and calibration procedures used.

10.0 REFERENCES

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3. Pressley, T.A., and J.E. Longbottom, "The Determination of Organohalide Pesticides and PCBs in Industrial and Municipal Wastewater: Method 617," U.S. EPA/EMSL, Cincinnati, OH, EPA-600/4-84-006, 1982.
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9. U.S. EPA 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule," October 26, 1984.

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11. U.S. Food and Drug Administration, Pesticide Analytical Manual, Vol. 1, June 1979.
12. Sawyer, L.D., JAOAC, 56, 1015-1023 (1973), 61 272-281 (1978), 61 282-291 (1978).
13. Official Methods of Analysis of the Association of Official Analytical Chemists, 12th Edition; Changes in Methods, JAOAC 61, 465-466 (1978), Sec. 29.018.

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TABLE 3. QC ACCEPTANCE CRITERIA^a

Parameter	Test conc. (ug/L)	Limit for s (ug/L)	Range for \bar{x} (ug/L)	Range P, P _s (%)
Aldrin	2.0	0.42	1.08-2.24	42-122
α -BHC	2.0	0.48	.98-2.44	37-134
β -BHC	2.0	0.64	0.78-2.60	17-147
δ -BHC	2.0	0.72	1.01-2.37	19-140
γ -BHC	2.0	0.46	0.86-2.32	32-127
Chlordane	50	10.0	27.6-54.3	45-119
4,4'-DDD	10	2.8	4.8-12.6	31-141
4,4'-DDE	2.0	0.55	1.08-2.60	30-145
4,4'-DDT	10	3.6	4.6-13.7	25-160
Dieldrin	2.0	0.76	1.15-2.49	36-146
Endosulfan I	2.0	0.49	1.14-2.82	45-153
Endosulfan II	10	6.1	2.2-17.1	D-202
Endosulfan Sulfate	10	2.7	3.8-13.2	26-144
Endrin	10	3.7	5.1-12.6	30-147
Heptachlor	2.0	0.40	0.86-2.00	34-111
Heptachlor epoxide	2.0	0.41	1.13-2.63	37-142
Toxaphene	50	12.7	27.8-55.6	41-126
PCB-1016	50	10.0	30.5-51.5	50-114
PCB-1221	50	24.4	22.1-75.2	15-178
PCB-1232	50	17.9	14.0-98.5	10-215
PCB-1242	50	12.2	24.8-69.6	39-150
PCB-1248	50	15.9	29.0-70.2	38-158
PCB-1254	50	13.8	22.2-57.9	29-131
PCB-1260	50	10.4	18.7-54.9	8-127

s = Standard deviation of four recovery measurements, in ug/L.

\bar{x} = Average recovery for four recovery measurements, in ug/L.

P, P_s = Percent recovery measured.

D = Detected; result must be greater than zero.

^aCriteria from 40 CFR Part 136 for Method 608. These criteria are based directly upon the method performance data in Table 4. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 4.

TABLE 4. METHOD ACCURACY AND PRECISION AS FUNCTIONS OF CONCENTRATION^a

Parameter	Accuracy, as recovery, x' (ug/L)	Single analyst precision, s_r' (ug/L)	Overall precision, S' (ug/L)
Aldrin	0.81C+0.04	0.16X-0.04	0.20X-0.01
α -BHC	0.84C+0.03	0.13X+0.04	0.23X-0.00
β -BHC	0.81C+0.07	0.22X+0.02	0.33X-0.95
δ -BHC	0.81C+0.07	0.18X+0.09	0.25X+0.03
γ -BHC	0.82C-0.05	0.12X+0.06	0.22X+0.04
Chlordane	0.82C-0.04	0.13X+0.13	0.18X+0.18
4,4'-DDD	0.84C+0.30	0.20X-0.18	0.27X-0.14
4,4'-DDE	0.85C+0.14	0.13X+0.06	0.28X-0.09
4,4'-DDT	0.93C-0.13	0.17X+0.39	0.31X-0.21
Dieldrin	0.90C+0.02	0.12X+0.19	0.16X+0.16
Endosulfan I	0.97C+0.04	0.10X+0.07	0.18X+0.08
Endosulfan II	0.93C+0.34	0.41X-0.65	0.47X-0.20
Endosulfan Sulfate	0.89C-0.37	0.13X+0.33	0.24X+0.35
Endrin	0.89C-0.04	0.20X+0.25	0.24X+0.25
Heptachlor	0.69C+0.04	0.06X+0.13	0.16X+0.08
Heptachlor epoxide	0.89C+0.10	0.18X-0.11	0.25X-0.08
Toxaphene	0.80C+1.74	0.09X+3.20	0.20X+0.22
PCB-1016	0.81C+0.50	0.13X+0.15	0.15X+0.45
PCB-1221	0.96C+0.65	0.29X-0.76	0.35X-0.62
PCB-1232	0.91C+10.79	0.21X-1.93	0.31X+3.50
PCB-1242	0.93C+0.70	0.11X+1.40	0.21X+1.52
PCB-1248	0.97C+1.06	0.17X+0.41	0.25X-0.37
PCB-1254	0.76C+2.07	0.15X+1.66	0.17X+3.62
PCB-1260	0.66C+3.76	0.22X-2.37	0.39X-4.86

x' = Expected recovery for one or more measurements of a sample containing a concentration of C, in ug/L.

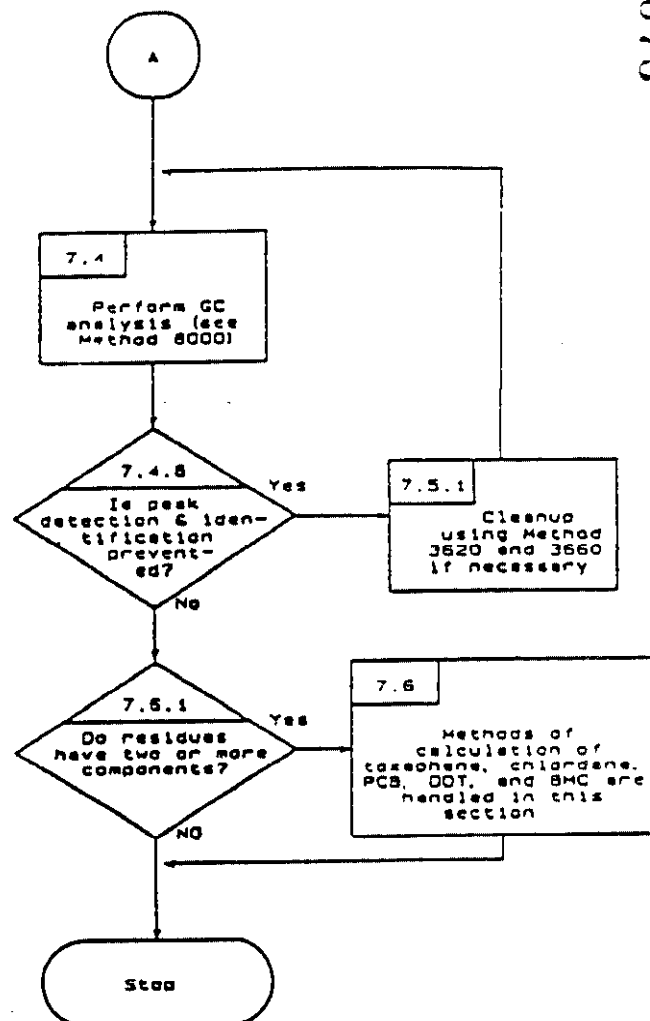
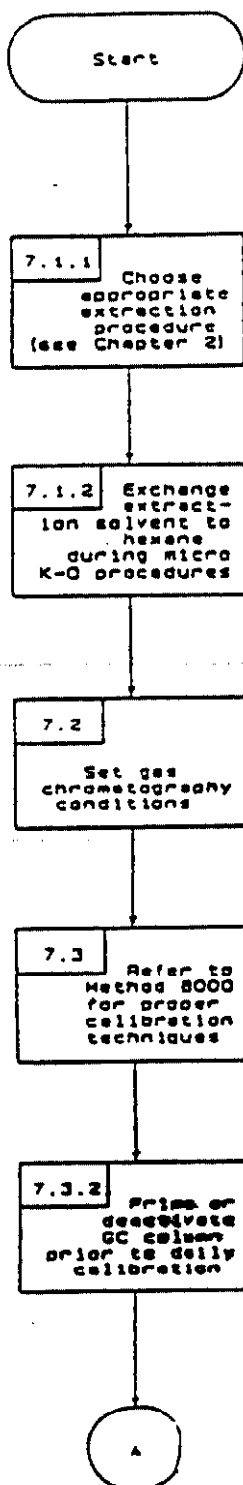
s_r' = Expected single analyst standard deviation of measurements at an average concentration of X, in ug/L.

S' = Expected interlaboratory standard deviation of measurements at an average concentration found of X, in ug/L.

C = True value for the concentration, in ug/L.

X = Average recovery found for measurements of samples containing a concentration of C, in ug/L.

METHOD 8080
ORGANOCHLORINE PESTICIDES & PCBs



REFERENCE 4

TRACK-1 RISK EVALUATION SUMMARY

DATE: 1/24/92

SITE: CPP-49

SUMMARY:

A track-1 assessment was conducted to establish risk-based soil screening concentrations to evaluate PCBs contamination at CPP-49. The dimensions of the contaminated region evaluated in the track-1 assessment are: 6.71 m wide and 14.9 m long, with a depth of 0.61 m. Toxicity data for Aroclor-1260 was used in the evaluation of PCBs. PCBs are classified by the EPA as B2 probable human carcinogens.

The calculation of soil screening concentrations was based on a target risk level representing a hazard quotient of 1 (based on noncarcinogenic effects) or a cancer risk of $1.0E-06$ (based on carcinogenic effects). The evaluation followed the track-1 guidance for the assessment of low probability hazard sites at the INEL (DOE/ID-10340(91)).

A summary table of risk-based soil screening concentrations for PCBs is attached. Soil screening concentrations were calculated for both industrial and residential scenarios. The residential scenario considers exposures to individuals living at the site under contaminant conditions that would exist in 100 years (after institutional control). Two potential exposure pathways were evaluated, as applicable to PCBs and based on the availability of toxicity values: soil ingestion and groundwater ingestion (for residential scenario only).

The shaded box in the attached tables shows the lowest risk-based soil concentration for PCBs. The ingestion of groundwater pathway provided the most significant risk (lowest risk-based screening soil concentration) for PCBs.

**SUMMARY TABLE OF RISK-BASED SOIL SCREENING CONCENTRATIONS FOR
CPP-49 SOIL CONTAMINATION FOR PCBs (AROCOR-1260)**

Exposure	Scenarios			
	Occupational		Residential	
Pathways	Soil Concentration at 1E-06 Risk (mg/kg)	Soil Concentration at HQ = 1 (mg/kg)	Soil Concentration at 1E-06 Risk (mg/kg)	Soil Concentration at HQ = 1 (mg/kg)
Soil Ingestion	7.40E-01	--	8.31E-02	--
Inhalation of Fugitive Dust	--	--	--	--
Inhalation of Volatiles	NA	NA	NA	NA
Groundwater Ingestion	NA	NA	6.25E-02	--

NA = Not Applicable.

-- = Calculation not performed because of no published toxicity value.

Shaded box = Lowest risk-based soil concentration.